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Impact of Science-Technology- Society Teaching Approach On Students' Academic Performance and Interest Among Secondary School Students Taught Mechanics At Giwa Education Zone, Kaduna, Nigeria

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ABSTRACT

The aim of present study was to determine impact of science-technology-society (STS) approach on students' performance and interest among students taught some topics in mechanics. 109 students from 2 schools randomly select out of a population of 1,803 participated in the study. The research design of the study was Quazi-experimental with pretest treatment posttest approach. Physics Academic Performance Test (PAPT), Physics Interest Test (PIT) and Lesson plan designed on some topics in mechanics designed using STS approach were the instruments used. The experiment group was taught using STS approach while the control group was taught using lecture method. Data collected were analyzed using t-test and Mann-Whitney U-Test for testing two null hypothesis set. Results indicated significant difference in academic achievement and positive improvement on interest in Physics among subjects exposed to STS approach. Due to the potential shown by STS approach, it is recommended that Physics teachers should employ sufficient use of the approach for better performance and increased interest in science which is needed for overall scientific and technological development of a nation.

Keywords: Impact, Science-Technology- Society Teaching Approach, Students, Academic Performance and Nigeria

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1. INTRODUCTION

Physics is one of the basic science subjects taught in schools and its concepts and techniques underpin the progress of all other branches of science (Morenzi 2009). Physics extends and enhance, the understanding of other discipline such as the earth, agricultural, chemical, biological, environmental science, astrophysical and cosmology subjects of substantial importance to all people of the world. Physics generates fundamental knowledge needed for the future technological advances that has and will continue driving the economic engines of the world. (IUPAD 1999).

The main aim of teaching physics at the secondary level is to contribute to the achievement of the general objectives of science teaching, and to emphasize the specific nature of physics and its relations with other science discipline. Other aims of teaching physics as cited by Adeyemo (2010) includes the following:

i) Giving the students a scientific knowledge through enlarging their scope of knowledge; interpreting their scientific observations, understanding laws, modern and theories of natural phenomena; and relating physical laws to technological applications.
ii) Preparing students for scientific careers based on physics and to awaken their scientific vocation.
iii) Making students aware of the scientific methods with all rigours, intellectual honesty and critical thinking it requires.
iv) Training students to express themselves scientifically through the use of the appropriate terminology and abstract representation.
v) Stimulating and enhancing creativity.
vi) Provision of essential skills and altitude as a preparation for technological application of physics. (Adeyemo 2010).

Despite the importance and well stated aim and objectives of teaching and learning of physics, the students' performance on the subject has not been encouraging. (Adesina 2011, Gambani 2010). The senior secondary school certificate examination (SSCE) in science and physics in particular, has been rated as poor by many researchers. Asim, Basey & Essein (2005) for example conducted a five-year trend analysis of WAEC/SSCE results aimed at determining the level of students' performance in O'level science, technology and mathematics (STM) subjects and the suitability of the students to pursue STM-based courses in tertiary institutions. The consensus of the result from the study indicated that the student's performance in science was poor with physics having the worst quality of performance. In a similar trend Sakiyo & Badau (2015) studied trend, on students' academic performance on science subjects and English in WAEC/SSCE from 2008-2012. They found out that there was increase in enrollement, average performance in physics was 56.01%, failure rate was 13.08% and 46.50% of candidate who sat for the examination obtained credit, pass.

Researchers like Bajah 2000, Jegede 2007, Gambari 2010, Adesina 2011 and Gambari & Yusuf 2015 have identified some causes of students' poor performance in science subjects to include poor teaching method, abstract nature of science concepts and teacher-centered instruction. The section or concept found to have record of poor performance in physics was mechanics (Gambari & Yusuf 2015). Mechanics is a major unit of physics that has the largest number of difficult concepts (Gambari & Yusuf 2015). More than 30% of SSCE/WAEC physics examination questions were found to be from mechanics (Rafiu & Adetona 2006, Gambari & Yusuf 2015). Some topics under mechanics identified where poor performance were recorded include elasticity properties of solid, kinetic theory, simple harmonic motion, projectiles motion, properties of matter, equilibrium of forces and mechanical energy (Gambari & Yusuf 2015).

2. THE PROBLEM STATEMENT

One of the major worry that prompted present study is students' performance in science and Physics in particular in SSCE/WAEC examinations. Statistics from WAEC as presented in Table 1 indicated high enrollment but inconsistent and unsatisfactory percentage of students who score credit pass in Physics nationwide and poor and fluctuating Mean score per annum for Physics.

Table 1: Students SSCE/WAEC mean scores on Physics for the year 2010 to 2015 in Nigeria.

Year	No. of candidates that sat	Mean score	% of pass	% of failure
2010	463,755	20	51.27	48.73
2011	563,161	24	63.94	36.06
2012	624,658	30	68.74	18.27
2013	624,648	24	86.24	11.70
2014	665,669	16	87.80	09.20
2015	658,393	19	84.92	13.08
	Mean value	**22.17**	**73.82**	**22.89**

Source: www.waeconline.org

From Table 1, the average mean percentage score over the five year range (2010-2015) was 73.82% and the average failure rate over was 22.85%. Despite the moderate pass rate over the years, the second problem is the student interest. Solbes & Vilches (1997) reported absence of science, technology and society (STS) interaction in science teaching as the major cause of students' poor interest and performance in science. Solbes & Vilches (1999) surveyed 212 students in Physics and Chemistry in their last three years of secondary education, in Spain. It was generally found that students have a vision of science that is removed from the world in which they live. The students see science and their work to be disconnected from the natural relationships between science, technology and society. All of these vision contribute to students' lack of interest in physics and chemistry and the rejection of their studies which has impact on their performances.

Based on the problems identified, present research studied effect of STS teaching approach on students' academic performance and interest in physics. STS strategy presents science in the context of societal issues through relevant technology. STS focuses on personal needs of students such as science concepts and processes skills that are useful in daily living of students (Yagger 1993). It also focus on societal issues in the homes, school and community. (Tete 2011).

2.1 Research Questions

Based on the problem identified, the following research questions were developed for answering:

1) Is there any difference in academic performance between students taught physics using STS approach and those taught using lecture method?
2) Is there any difference in attitude toward physics between students taught using STS approach and those taught using traditional method?

2.2 Null Hypotheses

Two null hypotheses were formulated for testing at $p \leq 0.05$ significant level. The hypothesis are:

1. There is no any significant difference in the mean academic performance scores between students taught Physics using STS approach and those taught using lecture method.
2. There is no any significant difference in interest toward Physics between students taught Physics using STS and these taught using lecture method.

3. METHODOLOGY

The research design for present study was Quazi-experimental with pretest, treatment, posttest approach. The population of the study was 1,803 senior secondary school students within 16 senior secondary school, at Giwa Education zone of Kaduna state. Two coeducation secondary schools were randomly selected for the study and intact class from the selected schools were the study subjects used. 51 students were the subjects for experimental group while 58 students served in the control school. 109 sample size was found suitable for an experimental research according to Tuckman (1978).

Three instruments were used for the research. Physics Academic Performance Test (PAPT) developed by the researcher and Physics Interest Test (PIT) adopted from Vaino & Rannikmae (2015) were the two instruments used with reliability coefficient of 0.79 and value of 0.88 respectively. PAPT was a 35 multiple item test developed around the topic of mechanics while PAT was a 27 items test on Physics interest on some selected topics and concept. Seven lessons plans on the subtopics elasticity, kinetic theory, simple harmonic motion, projectile and equilibrium forces were developed using STS lesson plan for experimental group. Seven lesson plans using lecture method were developed for the control.

Pretest using the two instruments was administered before treatment. Teaching lessons for experimental and control group lasted seven weeks. Post test was administered to assess the impact of treatment.

4. RESULT

Data collected on Physics Academic Performance Test to test null hypothesis, one was analyzed using t-test statistic. The result for the analysis is presented in Table 1.0.

Table 1.0: t-Test Analysis of Mean scores of experimental group and control group on academic performance

Group	N	$\underline{X}$	S_d	SE	d_f	t_{value}	P	Remark
Experiment	51	27.80	6.72	42.76				
Control	58	20.13	3.45	9.81	107	6.73	0.03	Significant

Significant at $P \leq 0.05$

From Table 1.0 the calculated t valve is 6.73 and the P valve in 0.03 which is less than 0.05 significant level, as such null hypothesis one was rejected. This implies that difference in the main performance scores between experimental and control group was significant. The mean scores for experimental group was about 28 and that of control was 20.00. The mean score for experimental group is higher than that for control group. This mean that the students exposed to STS approach perform significantly better than t their counterparts taught using traditional lecture method. Data collected on students interest test to test null hypothesis two was analyzed using Mann-Whitney U-test statistic.

The result for the analysis is presented in table 2.0.

Table 2: Mann-Whitney U – test of experimental and control groups on Interest

Group	N	$\underline{X}$	Sum of rank	U	Z	P	Remark
Experiment	51	70	2.52	119	2.39	0.017	Significant
Control	58	56	6.54				

Significant at $P \leq 0.05$

From the result in table 2.0 the calculated U valve is 119 and the Z value in 2.38 while the P value is 0.01 which is lower than limit of significant valve of 0.05. The null hypothesis two was therefore rejected, which implies that the change in subject interest on physics after exposure to STS strategy was significant. Confidently the mean scores of 70 for experimental group and 56 for control group the mean score for subjects taught using STS have higher mean value. This means interest in Physics is greater than for those taught using lecture method.

5. DISCUSSION

The result of test on null hypothesis one indicated that exposure to STS teaching approach enhances significant improvement of students' performance in Physics. The result is in agreement with the finding of Akay & Yager (2010) and Tete (2011) who found that STS teaching strategy makes learning interesting, enjoyable and makes students to perform better than those exposed to lecture method. Findings of Amirshokoohi (2016) added support to present finding which indicated better understanding of scientific concept implying increase in scientific literacy. Possible reason for better performance using STS could be that the scientific concepts and processes taught were prepared and presented in relation to the learners' common experience within their environment which makes the learners more committed to understand their environment better. However contrary to the agreement in the finding of Yager (2009) who found out that concept mastery is same in STS and non STS lessons. This could be due to high standard of education set up in Yager (2009) study area.

The finding on improvement on students' interest as a result of exposure to STS strategy is in agreement with the findings reported by Beneneth, Hogardth, Lubben & Robinson (2005) that boys and girls in classes using context-based approach hold significantly more positive attitude to science than their counterparts in classes using traditional of approach. Ackay & Ackay (2015) also reported that STS approach raises students interest towards career related to science and technology because concept taught are usually put in practical application perspectives which generates and sustain interest.

The implication of the findings of present research is that presenting science content in the context of societal issues through using relevant technology is one effective method for enhancing students' performance and generating students' interest which is needed for individual and national scientific and technological development.

6. CONCLUSION

From the result discussed, it can be concluded that the STS approach has a good potential for enhancing students' academic performance and interest in science which is needed for scientific and technological development of individuals and nation in general.

7. RECOMMENDATION

Based on the potential of the STS strategy it is recommended that Physics teachers should employ STS approach in designing and presentation of their lessons in order to enhance better academic performance, positive interest and general scientific literacy for general overall development of Nigeria..

REFERENCES

1. Adeyemo, S. (2010), Teaching/Learning Physics in Nigerian Secondary Schools: The Curriculum Transformation, issues, problems and prospects *international Journal of Education Research and Technology* 1(1), 99 – 111.
2. Akay H. & Yager R.E (2010). The Impact of STS Teaching Approach on Student Learning in Five Domains. *Journal of Science Education and Technology* 19, 9, 602-611.
3. Akcay B. & Akcay H. (2015). Effectiveness of Science – Technology-Society (STS) Instruction on Student Understanding of the nature of Science and altitudes towards science. *International journal of Education in Mathematics Science and Technology* 3, (1), 37 – 45.
4. Amirshokoohi A. (2016). Impact of STS Issues oriented Instruction on Pre-Service Elementary teachers' views and perceptions of science, technology and society. *International Journal of Environmental and Science Education* 11(4) 359 – 387.
5. Asim, A.E., Bassey U.U 8c Essien M.I. (2005) Trend Analysis of West African Senior Certificate Examinations Result in Science Technology and Mathematics (STM): Implications for Learning in Nigerian Secondary Schools, A paper presented as the 31st Annual Conference of International Association of Educational Assessment in Nigeria.
6. Bajah S.T (2000). The State of Science Technology and Mathematics Education in Africa. *UNESCO* (925) 3 – 4.
7. Campbell B., Lubben F., Dlamini Z, (2000) "Learning Science through Context: Helping Pupils make sense of every situations" *Journal of Science Education* 22, 3, 239 – 252(14).
8. Gambari I.A (2010) "Effect of Computer Supported Cooperative Learning Strategies on the Performance of Senior Secondary Students Ph.D Thesis, University of Ilorin, Nigeria.
9. IUPAP (1999) Statement to the Importance of Physics to the Society. Iupap.org/general-assembly/23rd-general-assembly retrieved 26/10/2016.
10. Jegede S.A (2007), Students' Anxiety Towards the learning of Chemistry in Some Nigerian Secondary Schools, *Educational Research and Review* 2(7), 193 – 197.
11. Kok L. & Van Schoor R. (2014). A Science Technology-Society Approach to Teacher's Education for the Foundation Phase; Students empiricist view. *South African Journal of Childhood Education* 4, 1, 95 – 110.
12. Lubben, F. Bennet J., Logarth S. (2005). A Systematic Review of the effect of context based and STS Approach in the teaching of secondary science: Review Summary University of York, UK.
13. Murenzi R. (2016) Contribution of Physics to Economic Development SciDev.Net retrieved on 24/10/2016.
14. Smith E.T & Aruna D.K (2014), Effect of Science Technology Society Approach on Achievement, Motivation in Biology of Secondary School Students of Kasaragod District. *Journal of Humanities and Social Science* 19, 4, 54 – 58.
15. Solbes J. & Vilches A. (1989) STS Interactions and Teaching of Physics and Chemistry *Science Education,* 81, 377 – 386.
16. Tete D.B. (2011) Effects of STS Instructional Strategy on Academic Performance in selected Genetic Concepts among NCE Students. Unpublished M.Ed Thesis submitted to ABU Zaria.
17. Tuckman B.W. (1978) Measuring Educational outcomes, Harcourt Bruce Jarvack Inc.
18. Vaino K. & Rannikmae (2015) Enhancing Students Interest in Science and Technology related careers through a specially designed optional Course. *Procedia-Social and Behavioral Sciences* 177, 22, 331 – 335.
19. Yager R.E, Choi A., Yager S.O. & Akcay H. (2009). A Comparison of Student Learning in STS vs those in Directed Inquiry Glasses. *Electronic Journal of Science Education* 13, (2), 186 – 208.
20. Yusuf, M.O, & Afolabi, A.O. (2010). Effect of Computer Assisted Instruction (CAI) on Secondary Schools Students' Performance in Biology. *The Turkish Online Journal of Educational Technology* obtained 30/10/2016 from http://www.tojet.edu.com